

## Nevyansk leaning tower

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Nevyansk is the cradle of metallurgy in Russia and Demidovs' ancestral estate, who were talented industrial-entrepreneurs, companions of Peter the Great.

Armorsmiths Nikita and Akinfiy Demidovs from Tula, which are known for their perseverance and fury, were the founders of Nevyansk. Whatever case they took in attention, they always tried to solve it in the best way they could. "It was a lot of common in their characters: ... worked up their fingers to the bone, do not know the boundaries of their intentions", – D. Mamin-Sibiriyak wrote about Demidovs' family and its patron Peter I.

The Stone Belt for a long time had been attracting adventurous people. Some of them even received the permission from the tsar to build plants. However, catching the luck is always easier than keeping it. And only Demidovs' family, due to the energy and passion, which were rare character traits at that time in Russia, were the first in the Urals able to get much-needed iron for Russia. It happened at the Nevyansk plant on 15 December 1701. This date counts the history of metallurgy in the Urals.

Found on rivers Tagil and Neiva (the plant was called in its honor) ore that is rich of magnetite required a special process of melting, which was not yet known in Russia. Archival documents told that Akinfiy Demidov went to Saxony to get acquainted with the process of melting magnetite. It's hard to say whether this trip was helpful or not: Saxon's ore was much less stronger than Tagil's ore. And, apparently, Ural's masters (or rather – Nevyansk blast furnace workers) independently found the technology of melting his ore. Its distinguishing feature is a long roasting, during which magnetite was transforming into self-fluxing ore. From this initial material iron has been manufactured with its astonishing qualities [3].

The end of the 17<sup>th</sup> century became a fateful moment for the Demidovs' family. According to the legend: "One of our nobles, who had been abroad, had brought a gun to the Peter. The Tsar was very amused by the gift, but unfortunately broke the trigger. There were no masters in Moscow able to fix it. Someone suggested to request Tula's ones, where the blacksmith Nikita Demidov-Antufiev lived famous for his agility and skills. Peter, who was going to Voronezh, took a gun with him, stopped in Tula and ordered to call the blacksmith, who declared that the problem could be fixed, but he needed time. Peter left his gun in order to take it back when he goes back to Moscow. Two months later the Emperor came back to Tula and asked about his order. Nikita Demidov brought him the gun. After looking around it Peter praised and said to the blacksmith:

– What is the gun! Will I live in future to see everyone in Russia work like this?

– Well, maybe we'll be on a par with Germans, – said Nikita.

Unfortunately Peter drank an extra glass of anise and these hateful words he had heard so many times, enraged him. He did not keep his hands down and shouted, banging on the Antufiev's cheek: "First do, swindler, then praise!"

– And you, Tsar, – said blacksmith, – find out first, and then fight me.

At these words, he took out a gun from his pocket and continued:

– Which at your mercy, that is my job, but yours is outlandish.

Look in gat the gun delighted Peter came to Nikita and embraced him.

– I'm sorry. I see, you are a good worker – he said" [5, p. 15].

Peter I appreciated Nikita's talent and organizational abilities. He brought Nikita closer to himself, and when in 1700 Russian-Swedish war started, Demidov was appointed as a supplier of weapons for the Russian troops. "It is impossible to avoid the conclusion that the Battle of Poltava, and eventually the Northern War was won due to the Ural steel" – famous historian Kashincev wrote in his work "History of Metallurgy Ural".

It is impossible not to highlight the pearl from all of the buildings that were built after the 17<sup>th</sup> century in Nevyansk – the famous leaning tower, a unique architectural monument of the 18<sup>th</sup> century.

There is an old beautiful legend: after Akinfiy Demidov, the owner of large Ural's areas and of few plants, found out about the famous Leaning Tower of Pisa, he thought – "why we are worse, let me have the same one!". And with rousing tag line the construction of 57meter multi-tiered bell tower, especially slightly tilted to one side, had begun.

Terms and conditions of construction of the tower are not known. However, historians are inclined to believe that it was built in two stages: first, to 1725 – quadrangular, then (by about 1732) – octagon with a tent with a spire [1, p. 14]. The tower's height is 57.5 meters. Tower's deviation from the vertical is 1.778 m [1, p. 18]. Unlike the Leaning Tower of Pisa, which began to lean on one side due to incorrect assessment of the state of the ground (here it is more correct to use "falling tower", because it is actually falling down for centuries with tiny speed), Nevyansk tower is aleaning tower (not falling), because it was built as architect planned. One proof of this fact is the explanatory note of the Moscow Institute "Spetsproektrestavratsiya", which says: "For two years five cycles of observations of the dynamics of a possible tilt of the tower were done. They confirm that there is no progressive tilt..." [3].

According to architect R.P. Podolsky, the tower "in its common decision is the old Russian style architecture of multi-storey towers and steeples." Still, the tower is completely original, it is not a replica of similar ones. The tower is the creation of a talented architect, but not an epigone.

All moldings of cornices, capitals, columns, were made of special shaped bricks, which formed a characteristic brick architecture pattern. Window openings, repeated in all three tiers of octahedron typically have thin stretched columns with cubic capitals like in the Old Russian architecture. The

motif of toothed cornice which is crowning the top by two octahedrons is a subject of interest. It consists of large triangular teeth, which come out directly from complex section of overhanging eaves part that was not supported by them.

The great interest is the design of the iron beams on the first octagonal of the leaning tower. When it was constructing Demidov's architect used iron and cast iron ties for strength top of tier. However, neither iron nor cast iron alone could provide the necessary tension in the areas of strength: iron is too soft and can bend; cast iron is hard but fragile and can break. Apparently, then the architect came to the third highly original decision.

The cast iron beam that ran along the diameter from wall to wall was reinforced along its entire length with iron rod. And iron was directly implemented into the body of cast iron. This construction had provided the necessary margin of safety: iron prevents breaking of cast iron and cast iron prevents iron bending.

Such constructive solution indicated a very early architectural attempt to rightly combine two dissimilar materials, which gave excellent teamwork system and then widely used only in the 20<sup>th</sup> century in the combination of concrete and iron. [2]

Evidence that the builders of the tower were wise people is the appearance on the tower of lighting-conductor. Its installation outstrips the time almost a quarter of a century when Benjamin Franklin's discovery has been made. Demidov's lighting-conductor is a metal ball with a diameter of about 30 cm and the thickness of 1 mm, hollow inside. Also 25 hollow triangular spiky thorns about 40 cm long each chained to it. There was a metal strip that went into the ground from the ball along the wall.

The dome-like tent crowned the tower. Its design is a manifestation of builders' skills. This original solution is the first known case in the world practice.

The Leaning Tower of Nevyansk is a symbol of Demidovs' family power, decoration of the capital of their "kingdom". The builders of the tower brilliantly coped with the difficulties encountered during its construction. The tower was built so solidly that, despite the extremely unfavorable conditions in which it is in the past decade, it has not still been going to fall. Following the rigorous research the history has not preserved the name of the author of the project [1, c. 15], but its creation – the leaning tower will live forever through centuries as a symbol of human skills and talent.

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### **The building of the Main mountain government.**

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The building of the Main mountain government and now the Ural State Conservatory named after M.P. Mussorgsky located on the corner of Lenin Avenue and 8 March street is considered as one of the most significant architectural and historical monuments in Yekaterinburg. Only well-known Plotinka is older than this "stone treasure" of the Ural capital except works of wooden architecture.

In 1723 asingle-storey wooden house of Siberian ober-bergampt created by William de Gennin (whitewashed with lime «wattle and daub hut») was located on this place. In the years of 1734-1737 V.N. Tatishchev took the position of the Chief Commander of the Ural mining plants. He changed the name of the ober-bergampt into the Office of the Main government of Siberian and Kazanian factories and approved a project of a new brick two-storeyed building of the Office. The building had a high pitched roof, 34 rooms and galleries on post-columns was designed by Dutch architect "forest keeper" Johann von Banner. The project is now stored in the Sverdlovsk region archive. The construction was entrusted to Tyumen and Solikamsk bricklayers headed by I. Shaposhnikov. They erected the building in 1737-1739 and then a few years were spent to end up the final finishing. [5]

By the beginning of the XIX century the Mountain government was a powerful institution, which controlled the work of more than 30 factories in the Urals. Because of this fact the decision about the necessity of restoration of the building was made. The assignment to design the reconstruction project was entrusted to M.P. Malahov, well-known in the Urals and beyond their borders architect. His project was implemented in 1833-1835. According to the new project the internal planning structure was changed slightly, but it was significantly increased due to the erection of the third floor. The ancient rooms with sail and partly coffered barrel vaults were saved. The facade was fully modified and rebuilt in accordance with traditions of Russian classicism. [2]